APPLYING THE PRINCIPLES OF COMMAND AND CONTROL TO THE EMPLOYMENT OF EMERGENCY SERVICES IN THE AIR FORCE

EXECUTIVE DEVELOPMENT

BY: Robert L. Ditch
Chief, Support Operations
Aerospace Command and Control Center
Langley Air Force Base, Virginia

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ABSTRACT

The problem was that there was no consistent application of command and control definitions, systems, or models for the employment of emergency services in the United States Air Force compatible with other doctrinal or civilian sources. The purpose of this research was to identify the various definitions, systems, and models used for the application of command and control for emergency services and provide recommendations for the application of them in the Air Force.

The applied research project questions were:

1. What definitions are available for defining command and control?
2. What systems or models are available for describing command and control and what are the characteristics and or principles of each?
3. Which of these, or other command and control definitions, systems, or models are subscribed to and employed in the Air Force.?

Action research was used to answer these questions. The procedures included discovery of what mechanisms existed, what various theorist suggest, and what agencies may offer for utilization in the field.

The results determined that, while there was no single system present in the Air Force for defining the principles of command and control for emergency services, there were definitions available for other services, and civil agencies had applicable designs which could be employed.

Six recommendations were made as a result of this research:

1. The United States Air Force should apply the same principles for command and control as advocated in Air Force Doctrine for the employment of its core competency of Agile Combat Support.

2. Emergency service representatives in the Air Force should be trained to understand the principles of command and control, its tenets, and concepts of operation.
3. Courses should be incorporated into all levels of professional development of emergency responders to educate them in the principles of command and control.
4. A single model for command and control, preferably the Agile Combat Support Command and Control Cube (C2 Cube) be accepted as the design for the understanding of command and control processes, elements, and environments.
5. The GEDAPER process should be employed as a incident command decision making tool for all response agencies.
6. The Air Force adopt the National Fire Academy Standard Incident Command System model for use world-wide

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INTRODUCTION

The problem is that there is no consistent application of command and control definitions, systems, or models for the employment of emergency services in the United States Air Force compatible with other doctrinal or civilian sources.

The purpose of this research is to identify the various definitions, systems, and models used for the application of command and control for emergency services and provide recommendations for the application of them in the Air Force.

A major issue in the United States Air Force is the application of command and control within the support communities that enable combat aerospace power to be employed effectively. This is most critical in those areas that support the emergency response to fire, medical, explosive ordinance disposal, and disaster response. Whereas command and control doctrine exists for the application of aerospace power, it is lacking in definition and application within the emergency service response and support communities.

An action research methodology was used.

The applied research project questions were:

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BACKGROUND AND SIGNIFICANCE

For decades the concept of command and control within the emergency service communities of our country has been confused, misleading, and in many cases left up to those having little to no experience with making decisions during periods of uncertainty when lives and property were at risk. Many conceptual thoughts remained relatively naïve to the principles of command and control and were spent considering the fact that command and control was either exclusively all about commanding, or about the single application of either organizations and/or systems. None considered the fact that command and control embodied the inclusion of all the facets provided by the integration of organizations, decision-making processes, law and authority, sensor and decision support systems/tools, the operational environment, as well as the human element of command. Because of the relationship between both the Organizational Culture and Leadership blocks of the Executive Fire Officer Program's Executive Development curriculum, and the area of command relationships and decision making, it was decided that the study and research of command and control would offer a bridge to the curriculum and the current research applications. As a result, the research shows a distinct parallel relationship between organizations, their culture, and leadership applications in the areas of decision making within command and control definitions, systems, and models.

In some cases command and control theorists felt that the concept of command alone was satisfactory for the understanding of the concept of command and control. Others felt that with proper design of workable organizational structures, like the Incident Command Systems (ICS), the answers would become clear and executable. Still others believed that the application of supporting decision-making tools and systems could be employed alone to provide the answer.

In the area of "support", command and control operations enable commanders to lead operations within the contextual constraints of resources, adversaries, and environment. Often, command and control operations are simply referred to as "enablers" or "supporters" of operations. Since superior commanders do not specify the details of most command and control operations the responsibilities for the details of the implied tasks normally fall upon the operational commanders, or those in charge of the specific incidents. Commanders describe their command and control objectives, intents, resources, acceptable risks, and strategies to subordinates. A centralized plan for command and control operations is developed through an iterative planning process. At the lowest levels this is accomplished through a military Operations Order (OPORD) or civilian employed Incident Action Plan (IAP). These centralized execution documents (for command and control) may not eliminate the uncertainty of the moment, but they allow for the command and control process to be more executable and just as important as the plan itself. The application of the plan based clear assumptions, perceived threats, presumed resources available and their capabilities permits a logical direction for application of decision making options when applied in the world of uncertainty.

But to have an understanding of command and control requires the examination of various definitions, models, applications, and tenets.

LITERATURE REVIEW

To answer the first question, on what definitions were available, a number of sources were examined to come to a number of perspectives. From a military perspective the understanding of command and control required reviewing the definition provided in the Joint Chiefs of Staff produced *Depart of Defense (DoD) Dictionary of Military and Associated Terms (Joint Publication 1-20).*

Joint Publication 1-02, (1996) stated that "Command and control (C2) is the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. C2 functions are performed through and arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating and controlling forces and operations in the accomplishment of the mission." (p. 6). The *DoD Dictionary* leaves it up to the reader to group this arrangement of personnel, equipment, communications, facilities, and procedures into logical categories. The first category is personnel, which covers the human aspects of command and control. Next equipment, communications, and facilities, which are technology elements, needed to overcome the problems of integrating actions across space and time. This second category has to often had a tendency to dominate command and control because high technology applications characterize American practices. A third category called processes encompasses "procedures" which are applied by the authorities over those which they are designated to direct.

The *DoD Dictionary* goes on to list command and control functions as planning, directing, coordinating, and controlling. Planning is the process of examining the environment, analyzing threats, relating objectives with resources, and deciding on an applicable and hopefully successful course of action. Commanders in the field make decisions through a rational cost, benefit, and risk approach. Directing is the giving of specific instructions and guidance to subordinate units. Superior commanders often give specific instructions to subordinates on mission objectives, situation, resources, and acceptable risks. Commanders also provide guidance or "intent" to subordinates as a way to encourage initiative and reduce the uncertainties they may face. Coordinating is the sharing of information to gain consensus, to explain tasks, and to optimize operations. Controlling is a composite

function that uses parts of the planning, directing, and coordinating processes and adds dynamic feedback to modify and correct errant results. (p. 5)

In the military the term "command and control system" is often narrowly construed as the highly visible technological elements, such as satellite communications or computer systems. Again the *DoD Dictionary* defines command and control systems as the "facilities, equipment, communications, procedures and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the missions assigned" (p. 6) The key point from the definition is the concept of being "essential to a commander" for the assigned mission.

On 11 April 1997, the United States Air Force hosted the 1996 Command and Control Summit and the senior leadership in the Air force approved a new command and control vision that embraced an integrated command and control system to serve all commanders and functions across the full spectrum of operations from peace to war. The vision specified the operational and institutional changes needed to reshape command and control in the 21st Century. They also came out with two major actions. The first was a concise definition of command and control. The second was the formation new organization, the Air and Space Command & Control Agency (ASC2A) dedicated to integrating all command and control efforts to include programming for future dollars to be engaged in command and control development/fielding; developing and evolving doctrine; maturing technologies and equipment; experimenting with evolving processes, technologies, and organizations; and training command and control leaders and support personnel within the Air Force.

The definition from the Air Force (1997) stated that there were numerous ways to describe command and control. However, "they all contain three major elements: Sensing, Deciding, and Executing. The C2 system is comprised mainly of systems supporting the decision element, but also

includes the links to the sensors and execution elements." (p. 23) The charter for the newly formed ASC2A (1997) stated that "all three elements are interdependent and must be integrated to enable the effective application of operational strength." (p. 2)

Later, Synergy (1998) went on to better define command and control by stating that "command and control is the collection of the means and processes by which commanders are informed of situations and taskings, decide upon appropriate actions, and communicate orders to subordinate forces. However, command and control is seldom the same from one occasion to the next, because it must adapt to the situation, mission, forces assigned and applied, and the human elements on all sides." (p. 1-2)

This concept of operations was later mirrored in the revised *Air Force Doctrine Document (AFDD) Series* when it stated in *AFDD 1* (1998) that "Command is the art of motivating and directing people and organizations into action to accomplish missions. Control is inherent in command. To control is to regulate forces and functions to execute the commander's intent (desires and objectives). Command and Control includes both the process by which the commander decides what action is to be taken and the system which monitors the implementation of the decision." (p. 4)

For the United States Army and National Fire Academy research projects Dr. Klein in a video interview defined command and control in his concept of "Naturalistic Decision Making" through his application of "Recognition Primed Decision Making." Naturalistic Decision-Making studies how people use their experiences to make decisions. As parameters to his definition he stated that these types of decisions fall into a number of considerations. They included, decisions where,

1. There were critical time pressures.
2. There was a high degree of uncertainty.

3. Conditions change rapidly.
4. Goals were vague or unclear.
5. Stakes were high, and results from risks are unpalatable, but may be necessary
6. Confusion existed and information was lacking, misleading, absent or not trusted.

(Klein, 1996)

Under this concept he said that decision makers would not necessarily go through a decision processing tree, but rely upon their experience in choosing an appropriate (but not necessarily the best) course of action. In his discussion he went on to state that (firefighters) do not make decisions, but actually rely on procedures. They rely on their experience to direct actions based upon their experience and apply the first process which is successful versus taking time to rule out any list of best choices. His thesis was that "comparison of options" did not work under pressure or during times of uncertainty. Calderwood, Klein, and Clinton (1986) went on to say that there were some common beliefs to his definition. They were that,

1. Experience was more important than procedures.
2. Size up of a situation was more important than deciding what to do.
3. Most decision-makers relied on their first option that comes up.
4. Most believe that we don't have to pick the best choice, only the first one that work and will do the job.
5. Experienced decision-makers can play out the options in their head. (p. 576)

Burkel and Wood (1999) amplified Klein's philosophy on command and control stating that the "decision making process appears to be very natural because the decision maker is able to read critical cues and has a relevant context or experience base." (p. 42) They also went on to restate

Klein's common beliefs as being instructive conclusions. Miller (1996) supported this contention by adding the fact that most experiences can be considered as slides in a carousel of experience that can be used, become faded, or be absent (in the case of no experience at all).

(p. 38)

In the United States Marine Corps, Lieutenant General Paul Van Riper, Commander of the U.S. Marine Corps Combat Development Command, supported Klein's theories in the aforementioned video interview, focusing on a presentation of "Pattern Recognition." In this definition, he stated that effective decision-makers must make decisions in spite of uncertainty. This is especially true for those under duress or under combatant like conditions. (Riper, 1996) In his book, *The Spirit of Leadership*, Harrison (1989) echoed this concept when he quoted Andrew Jackson's statement "Take time to deliberate, but when the time for action arrives, stop thinking and go in" (p.152). With this perspective in mind, the decision-maker needs to be aggressive to the point of exhausting the enemy through a rapid influence of actions, derived through and uninterrupted flow of rapid-fire decision making. The "uncertainty" Riper alluded to could be best described by Clauswitz's concept of the "Fog of War" defined in his book,

On War. He later expanded his position and that command and control decision making is accomplished through the application of doctrine, organizations, equipment, and infrastructure; coupling experience derived from past operations, training, and simulations; with the assimilation of usable information being presented. It was through this coupling affect, command and control has revolutionized operations. (Riper, 1996)

One of the most broadest perspectives of command and control, but also one of the most narrowly applied (meaning only parts of it are ever applied in a smorgasbord fashion) was the concept

of the ICS. The concept of ICS grew out of the need to refine command and control organizational principles and practices follow a tourmultous period in 1970 when Southern California experienced two weeks of devastating wildland fires. Over five hundred and eighty thousand acres of watershed were destroyed. The National Fire Academy (1994) estimated the combined cost to fight these fires, and the losses that resulted, at "$18 million per day or $750,00 per hour." (p. 3-1) From this destruction came the need for the multiple jurisdictions in California to establish an executable command and control system for managing future incidents. As a result, a number of programs evolved from this devastation. The first was according to Halsey (1980) the U.S. Forest Service concept of Large Fire Organizations (LFO). (p.193) From this effort the federally funded project known as **FIRESCOPE** or **Fi**re **R**esources of **S**outhern **C**alifornia **O**rganized for **P**otential **E**mergencies was developed. It was defined by the International City Management Association (1988) as the framework for command and control, and a " integrated set of personnel, politics, procedures, and equipment linked together with a common organizational structure to perform a specific mission, usually the management of resources assigned to an incident." (p. 340) Podlubny (1992) described it as "a management tool provided to mitigate a major emergency through a systematic means of planning, organization and control. (p. 10) According to Pyne (1984) the evolution of ICS "revolutionized the somewhat empirical structures that characterized (FIRESCOPE and) LFO, provided a common language by which to merge wildland and urban (or rural) fire services, generalized the response such that it could apply to any emergency, and from one agency to many." (p. 377) Over the years the concept of ICS has taken on many forms but always the same basic premise and definition. Most notable was Brunacini's (1985) *Fireground Commander System*, and those standardized terms and processes evolving according to Wieder (1996) with the National Fire Service Incident Management System (NFSIMS) Consortium on incident

command hosted at the numerous locations in the U.S. throughout 1990-1991. M. Player (personal communication,

4 July 1999) stated that these meetings culminated in a standardization of terms, organizational structures, and responsibilities now taught at and through both the National Fire Academy and Emergency Management Institute, (again both) located at the National Emergency Training Center, Emmitsburg, Maryland.

Butler and Heavilin (1995) stated that to make the ICS definition work, then the definition needed to insure that the system had basic design and operational requirements. These included,

"1. An organizational structure that is easily adaptable to any emergency incident no matter how small or complex.

2. A response organization that can expand in a logical manner from initial response to long term operations.
3. A system that is applicable and acceptable to a variety of emergency responders throughout the country.
4. A system that is readily adaptable to new technology.
5. A system that uses basic organizational elements, terminology, and procedures that allow for the maximum application and use of already qualified personnel, and that promotes effective integration of multi-agency responders." (p. 81)

To make the system work the elements required by system as stated by the International Association of Fire Chiefs (1992) included,

1. "Common Terminology for personnel, facilities, equipment, organizational positions, and operational procedures

2. A common organizational structure for the entire incident.
3. A modular organizational framework that is built from the top down and tailored to meet the specific type and quantity of resources needed for a particular incident.
4. Written or oral action plans to accomplish stated incident control objectives.
5. Integrated facilities used, as appropriate, by all participating agencies
6. Integrated communications providing interagency, interjurisdictional communications capability." (p.34)

According to the Curriculum Development Team for Emergency Response to Terrorism - Incident Mangement (1999) stated that a standard ICS structure is led by an Incident Commander (IC) who is responsible for overall incident management, approving the Incident Action Plan, and providing direction for command and general staff officers. The command staff includes a number of key players to include a safety officer responsible for overall incident safety (mandated by federal law for all Hazardous Materials Incidents); a liaison officer responsible for the interface with other agencies; and an information officer who compiles and releases incident information, with the approval of the IC, to the public and to incident personnel, and coordinates the activities of on-scene media. In addition to the command staff, a general Staff may be formed to support the functions of Operations, Logistics, Planning, and Finance & Administration.

(P. B-3)

One key facet of ICS was the need for single command authority, otherwise known in as both ICS and the military as the doctrinal concept of *Unity of Command* as executed in a Unified Command structure. There can be only one big boss for any incident and this was the cornerstone to the ICS model, insuring that absolute control exists over all responding and assigned personnel and

equipment. This minimized the ominous problems associated with the problem of uncontrolled convergence by those not within the ICS direction. This concept of Unity of Command was not widely accepted in the civil community where multiple jurisdictions had multiple top dogs representing their (hopefully) common goals and objectives. This challenge was most especially concerning with the evolution of emergency planning and response to terrorism. In the past, commanders employing ICS were thankful to be able to control forces so that the job got done effectively without injury. Today's concern for command and control, at terrorism incidents, is focused mostly on keeping responders from being killed. Without ICS the chances of free-lancing responders being killed by terrorists was increased dramatically. This was shown in the recent secondary bomb attacks targeting emergency responders. The National Fire Academy Terrorism Incident Management Curriculum Development Team (1998) stated that "ICS will also help in resource conservation and should prevent redundancy of efforts by multiple agencies. The real challenge is accurate scene assessment and analysis early in the event. The safest response to the conditions encountered should always be part of the early command decisions." (p. 6-7) and "If agencies start freelancing during the incident, the uncoordinated efforts could result in many responder fatalities and /or burden command with additional responsibility of rescuing responders (or recovering their remains). ICS can offer a structure to manage span of control and ensure that command decisions reflect the needs of all the agencies involved (Because we should keep in mind that responders are not canaries!). (p. 6-7)

Notwithstanding there are also legal considerations for applying some form of ICS. In accordance with *Title 29: Federal Code (29 CFR 1910.120)* every jurisdiction in the U.S. that has emergency response agencies is required by federal law to use a system or model in responding to hazardous materials incidents. (p.407) In addition, according to *Title 40: U.S. Code of Federal*

Regulations (CFR 40 CFR 311.1), although this provision specifically applies to OSHA states, all Environmental Protection Agency covered states are also instructed to adhere to this requirement. (p. 1071) And according to Hogan (1997) Failure to do so would place the agency in a position of either criminal or civil (or both) tort action for negligence. (p. 342) In most states however according to Schneid (1995) such cases would have to show gross negligence on the part of the agency or jurisdiction. (p. 52) This was because of the presence of legal practice of *Sovereign Immunity,* which protects government from being sued.

Colonel Kenneth Moll (1978) stated in his definition, that "One of the least controversial things that can be said about command and control is that it is poorly understood, and subject to wildly different interpretations" and that "the term can mean almost everything from computers to the art of generalship: whatever the user wishes it to mean. (p. 41) As a result everyone agrees that the topic was to broadly defined, and everyone wanted to remedy the problem by limiting the subject to a narrower definition his or her group would choose so the cycle of debates continues.

To confuse the issue even more, one imaginative theorist, Todd (1986) stated that the concept of Command & Control (C2) was really "C27, to include command, control, communications, computers, cohesion, counterintelligence, cryptanalysis, conformance, collaboration, conceptualization, correspondence, camaraderie, commissaries, camouflage calculators, cannon, caissons, canteens, canoes, catapults, carpetbaggers, caddies, carabineers, carrier pigeons, corn whiskey, camp followers, calamine lotion, etc." (p. 14)

The noted command and control researcher and author Coakley (1991) stated that due to the confusing nature of the wide variety of definitions he believed that most definitions fell within one of three parameters. Those included definitions involving technological issues, human issues, or those defined in

terms of organization. (p.10) In his own thesis he summed up command and control as "In general terms, being everything an executive uses in making decisions and seeing that they're carried out; it includes the authority accruing from his or her appointment to a position and involves people, information, procedures, equipment, and executive's own mind. A C2 process is a series of functions, which include gathering information, making decisions, and monitoring results. A C2 system is a collection of people, procedures, and equipment which supports a C2 process" (Coakley, 1991,p.53)

Again, moving more closer to the field of emergency services, Lesak (1999) stated that command and control involved a triad of constituents to make an effective system. These three elements included the,

1. Incident Command System for management.
2. Incident commander for commanding and decision making.
3. Operational Decision-Making processes. (p. 39).

His basic premise with his concept of "Operational Decision Making" was that many definitions, especially those in the case of ICS, left out the physiology of decision making and relied exclusively on rules and organizational structure. He likened it to describing the human body by only showing the skeleton and not the physiology or relationship to other systems. Lesak (1989) emphasized this early on a decade ago during the ICS evolutionary period stating that to "rely solely on the Incident Command System is not enough for today's wide-ranging large scale incidents. It's the management decision process the brings it all together." (p. 62) Continuing on he stated that "the command system is a vehicle driven by the operational decisions made by the incident commander. Together operational decision-making process provide a unified incident management process that is viable for an incident of any magnitude." (Lesak, 1989,p.63)

And finally Ditch (1999), stated that the definition of command and control included "Those processes of sensing, deciding, and executing; employed by organizations; to direct; through command relationship authorities; and supported by systems or modalities; within a spectrum of global, theater (or operational), and unit or tactical level environments."(p. 42) In this definition he assimilated and packaged what Coakley and others argued could be a balance between considering human issues; through the perspective of environmental issues; supported by infrastructure, architecture or systems.

The second question vectored the research into an analysis of command and control models that were available. As expected many but not all authors of definitions for command and control had their own applications for its execution.

The first, model came from Klein in his description of the *Recognition Prime Decision*-Making *Model*. In this model the individual experienced a situation in a changing context. In the simplest form, meaning the individual had been there before and experienced similar situations; he/she processes that information as perceived as typical. The recognition derives four byproducts. They included,

1. Expectancies.
2. Relevant cues.
3. Plausible goals.
4. Typical Action.

The later, typical action then is translated into the implementation of the course of action recalled. In a second case the situation may not be perceived as typical and the individual is required to best match the situation with a past event to select the applicable recalled response for a course of action. Through either diagnosis of the situation or mental evaluation of the appropriateness taken in the course of action the individual implements a final action to accomplish the task. In this type of model the

reliance on experience, training, and simulation of events is necessary to build a bank of learned or expected (from discussion, reading, or simulation) experiences for course of action analysis/selection. (Klein, 1996) This model is currently being taught by the National Fire Academy (NFA) as a decision support tool for individuals taking the command and control classes at that institution. In the NFA course text *Command and Control for Fire Departments at Natural and Man Made Disasters* it is referred to as the "Pressure Decision Making Process" and focused on incorporating Klein's thoughts and reliance on clues versus rules that are derived from the fireground to help in the decision making process (NFA, 1994,p. SM 1-14)

The next model was the U.S. Marine Corps *Pattern Recognition Model* provided by General Riper and described in *U.S. Marine Corps Field Manual 14-3*. It is somewhat similar to that hosted by Klein, in that it relies upon experience. But the Marines add additional variables to the equation. In their model they rely upon the factors of doctrine, organizations, equipment, training and infrastructure; infused with an influx of data, which is translated into usable information, which the individual eventually adjudicates on. Based upon their previous experiences and knowledge of similar incidents they are able to make a judgement call which translates into action. They believed in a steady flow of information converted to knowledge; leading to understanding, judgement, decisions, and finally action. (p. 25)

Another one known as *Lawson's Model* was described by Coakley (1991) as accommodating five functions. They included,

1. Sensing of information translated from data.
2. Processing that information, filtering it from non-essential information, and fusing it with, other information, experiences and learned information.
3. Comparing the information.

4. Deciding upon a course of action.
5. Acting on that course of action (p. 32)

Two other models described by Coakley included the *MAPE* and the *OODA Loop* models. The *MAPE Model* incorporated many of the above considerations in the *Lawson Model* but changed them some ways to include,

1. **M**onitoring the situation.
2. **A**ssessing the situation and data/information it derived.
3. **P**lanning a course of action.
4. **E**xecuting that course of action. (p. 36)

I In the *OODA Loop* a fighter pilot's perspective on command and control was applied as seen in an air battle. The *OODA Loop* was a circular event driven model where the fighter pilot was always engaged in some form of cognitive activity and never rested. It was with this in mind, he might survive. In this scenario of decision making he/she,

1. Constantly **O**bserved his/her environment.
2. Maintained full **O**rientation to his/her environment for friendly or enemy clues.
3. Recognized those clues and **D**ecided upon a plan for action.
4. **A**cted in a fashion to eliminate or support the clues. (p.45)

Lesak produced a model known as the *Operational Decision Model*, which was also taught as various courses (primarily hazardous materials response and emergency response to terrorism courses) at the National Fire Academy. In one course, Hazardous Materials Incident Management NFA (1995) it states that organizations only provide the backbone for the processes incorporated by models like prescribed by Lesak. (Lesak, 1989,p. 2-36)

He went on to describe this decision tool through what was called the *GEDAPER Process*. In the *GEDAPER Process* the decision-maker was involved in,

1. **G**athering information.
2. **E**stimating the potential course of the incident and harm it would cause.
3. **D**etermining strategic goals for mitigating against the incident or its outcome.
4. **A**ccessing tactical options and resources necessary to accomplish the strategic goals.
5. **P**lanning an action for implementation.
6. **E**valuating the operations.
7. **R**eviewing the overall process. (p. 41)

The final model provided by Ditch (1998) was the *C2 Cube*. In the *C2 Cube* Ditch combined many of the critical issues of environment, human involvement, system/infrastructure, and processes into a single equation. As an execution model the C2 Cub was best supported by numerous other concepts, principles, and various sets of structure, and was clearly validated by other definitions and systems. As in any cube, the *C2 Cube* was made up of three squared hemispheres, which described a major set of threes within the cube. The three sets included,

1. Command and control processes.
2. Command and control elements.
3. Command and control environments. (p. 15)

The processes of command and control that he used included the action processes of,

1. Sensing data and fusing/filtering it into usable information.
2. Deciding a best course of action to accomplish.
3. Executing or acting. (p. 15)

The elements of command and control described by Ditch included,

1. Organizations which may include commanders (whether on site or located elsewhere), command and control centers or nodes, or as Smith (1995) describes the Command Post, as the "nerve center" for the operation. (p. 16) To expand upon this, Cowardin (1989) stated that this organizational implementation involved both delegation of responsibilities in to smaller and more manageable units, and address the need communications discipline with all participants within the system. (p. 38)
2. Command Relationships, which included the authorities which lawfully permitted action (laws, codes, standard operating procedures, doctrine, plans, or directives), identified who was in the chain of command, and any other support or supporting relationships as described by Therrien (1995) as other decision making bodies (p. 102).

Auf De Heide said this was necessary because "agencies who assign commanders must have the authority to order, transport and maintain the resources necessary to meet command objectives. This authority is not dependent on size or budget level since even very small agencies may participate in a unified command structure. It is dependent upon legitimate capability to pay the bills. Only agencies with fiscal authority may assign one of the unified commanders" in an incident.

(p. 159) An example would be the on-scene commander, his staff, and his relationship and authority over assigned forces, and to the Emergency Operations Center (EOC). Carter (1989) stated that such authority could also rest in the Incident Action Plan. (p. 21) Because there are various authorities that can be used, as Sharp (1989) stated "Usually the answer is clear-cut from a legal standpoint. State laws mandate explicitly who is in charge. But as different states have different laws, it behooves emergency personnel to familiarize themselves with local statutes and include them in all

training courses." (p.62) Key to the authorities granted by law are those in the areas of incident management. The most important of these is the *Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93 -288 (Amended)*, (p. 24) and according to its supporting code, *Title 42 USC 5121*, "It is the intent of the Congress to provide an orderly and continuing means of assistance by the Federal Government to State and local governments in carrying out their responsibilities to alleviate the suffering and damage which result from such disasters". (p. 1) Witt (1994), the current Director of the Federal Emergency Management Agency, stated that the law not only outlines the authority and command and control responsibilities for the Federal Response Plan, but offers direction on its execution. (p. 2)

The final element of Ditch's C2 cube included the systems or modalities, which allowed for the aforementioned processes to be accomplished. This was supported by to Dunnigan (1983) when he stated that "less than a century ago, effective leadership was conducted without radio, telephone and other electronic tools. Today effective operations are impossible without electronic aids. Not only can we make leaders more effective by opening up the bandwidth and modalities available for him to communicate, we can also offer him integrated systems to manage the processing and analyzing of volumes of data and information." (p. 219)

As a result, you would think that, with all the above definitions and models, coming into the end of the 20th Century we would have systems that we could totally depend upon. But even in the great Air Campaign of Desert Storm this was not always the case. Britten (1997) asked the question "What tools did the planners have for this daunting task? Despite over 3,000 computers in the war zone data-linked to computers in the United States, much of this excruciating work was manually done" (p.1) and was according to Campen (1995) "conducted as it had been for decades paper charts, and grease

pencils." (p. 7) Notwithstanding, why should we be surprised if there is very little available for emergency service support activities in the Air Force, if the operations community was still using big crayons (with large erasers) in the largest air warfare campaign of the 20th Century?

But, in their future defense the recently retired Chairman of the Joint Chiefs of Staff, General Shalikashvili (1997) stated that "the vast array of information underpinned by doctrine is utilized to employ forces across a full range of operations. Command and control computer networks and systems provide the means to synchronize these forces." and "Improved interoperability, greater reliability and enhanced security achieved through rapid advances in information technology are essential for effective command and control as we enter into the 21st Century." (p. 1) These may include computer systems, radios, global positioning systems, identifiers or other linkages outside of the human scope. But even though these types of applications for decision make are not new, and have been around according to Neilsen (1967) in cities like Los Angeles and Phoenix since the early to mid eighties, they are no longer relegated to the fire dispatch centers or command posts. (p. 4) As stated by Large (1997) "because of the rapid introduction of new and more sophisticated computer software into all aspects of the workplace, it becomes apparent some of this technology could be utilized on the fireground. (p.33) And according to Christen (1989) we had reached the day where complete data bases can be purchased with a full range of applications, and that these systems can be delivered and operated right on the incident scene. (p.47) This allowed for what Goldfarb (1997) said was a multiplex of data sources to include units from the scene, prefire plans, reference guides, and On-line experts. (p. 70) Because at the operational level of command and control, according to the ICMA (1991) "computer programs have been developed to evaluate scenarios against hazard spread and impact patterns to support emergency management decisions." (p.157) The type of information

according to Kramer and Bahme (1992) included "guidance, direction, requests for assistance, status reports on the incident, and updates on resources and operations. More specifically they might include, disaster or incident alerting and warning, assessment of the incident nature, policy guidance, tactical guidance, situation status updates, resource status updates, plan activation updates, external support capabilities and or needs, technical data

and advice, objective environmental conditions analysis and projections, and checklists. (p. 69)

One interesting note of departure was the correlation between, systems, sources of control, organizations, and the environment in which they operate. This was suggested by

Flood (1993) when he stated that while "attention needs to be paid to the sources of command and control in a system, it should recognize that information is the true cement holding organizations together, and is capable of showing how control systems should be organized. It is its environment, both influencing it and being influenced by it." (p. 88)

The environments of command and control in Ditch's *C2 Cube* included the following.

1. Global. This included operations within the full jurisdictional boundaries of an organization. For the Air Force it included the entire planet and beyond into the aerospace reaches. For a civilian fire agency, it included the entire area of jurisdiction within the respective fire authority district, but not include mutual aid (unless specific compatible mutually supporting regional command and control programs are established).
2. Operational or Theater. This included the boundaries of the specific area of operation, regional theater, or specific incident scene. It was a bubble within the jurisdictional boundaries of the fire agency dedicated to the management of a specific incident or operation. It qualified the incident commander's geographic as well as functional authority. During Operation Desert Storm, General

Schwarzkopf (commander of all theater military forces) had operational command and control authority over every allied military force in the entire Middle East. A fire ground commander only had authority over the geographics of the scene given responsibility to manage (including staging, camps, and assigned support facilities).

3. Unit level or organizational. This included command and control considerations for a specific sector, division, region, or base within given operational areas. Examples in the Air Force included a single Air Base within the theater of operation. On the fire ground it included, designated areas like sectors, divisions, specific areas and staffs (both geographical and functional). This is where empowerment of lower ranking commanders by the senior theater or incident commander was delegated and defined. It also included the application of command and control to task forces, strike teams, or other specially set up intervention organizations within the overall incident mitigation management design. By this definition, it might be argued that every commander (at every level) had global, operational, and organizational level command and control capabilities under them. That was completely dependent on a number of things. It included the authority/responsibility invested in him/her by higher officials; the applicable the laws, or codes of legal authority state; the relative size, complexity, and protracted nature of the incident; and how much and how far the commander was willing, had the authority to, or capable of stratifying/cascading the delegation command and control down to other lower echelons of command for successful integration and management of the incident.

The third question asked what systems described above were applied in the Air Force. There were some Air Force Regulations and Manuals, primarily *Air Force Instruction*

(AFI) 32-4001, Disaster Preparedness Planning and Operations; AFI 32-4002, Hazardous Materials Emergency Planning and Response Program; and *Air Force Manual 32-4004, Emergency Response Operations*, discovered in the literature search which could validate that a universal "Air Force only" system was utilized. But there were no documents that showed compatibility with any of the above systems or models. The described system of emergency response management was primarily used for disaster response only and was not employed by all response agencies on a day to day basis for other emergencies. It was considered more of an organizational framework for military unique ICS establishment with some air base response applicable rules. It did outline organizational structures, command authorities, and unit/individual responsibilities, much like other ICS systems. (Air Force, 1995, p. 2) These however, these were not always understood by most of the participants in the response organizations, and were not always compatible with adjacent local or regional agency systems/models. Not withstanding the system was a good system tested and very responsive, but it did not provide compatibility with outside agencies.

PROCEDURES

Definition of Terms

Combat Support. Forces aligned under a commander in direct support of his weapons systems employment.

Command and Control**.** The purpose of this research was to examine the various perspectives of definition. See literature review on first question.

Filtering. The process of eliminating useless, meaningless data, from essential and usable information.

Fusing. The combining of data sources and filtered data into usable information

Incident Action Plan. A composite and directive civilian document originating from the Incident Commander defining the scope of an operation, goals and objectives to be attained, and resources to be obtained and used. The document is also used to assist in documentation of the incident.

Incident Command. The employment of ICS.

Incident Commander. The single highest authority located at and charged with managing the scene of an incident.

Modality. A system that assists in sensing data and translating (by filtering/fusing) it into usable information, participates as a host for decision-making, and in some cases actually executes a decision for the commander.

Modeling. The ability to describe a system or process through the application of theory, and descriptive analysis.

Negligence. The willful or unintentional action or inaction accomplished by an individual or agency which harms another; when acting outside their scope of authority; applying procedures that are less than the standard of care expected in similar situations; and the harm is directly linked to the action or inaction.

Operations Order. Like the Incident Action Plan. A military order describing the operation, commander's intent, threat, resources available, and concept of operations for the mission.

Simulation. The replication of scenarios, events or processes in a controlled environment that allows for individuals to participate in, and gain experience and training without having to participate in an actual event that is being replicated.

Systems. Linkage of process mechanisms for accomplishing product acquisition or decision.

Research Methodology

Action research methodology was used. The procedures included discovery of what mechanisms existed, what various theorists suggested, and what agencies offered for utilization in the field. The research employed a significant and exhaustive literature search coupled with an extensive telephone interview survey of fifty U.S. Air Force fire departments to collect the data and answer the three questions. The libraries at the Air University, Maxwell AFB, Alabama; Langley AFB, Virginia; William & Mary Law School and William & Mary University, Williamsburg, Virginia; Old Dominion University, Norfolk, Virginia; the Armed Forces Staff College, Norfolk, Virginia; National War College, Washington D.C.; the United States Air Force Publications Library, and the Learning Resource Center at the National Fire Academy, Emmitsburg, Maryland were used for the literature search. In addition, a series of personal interviews were conducted with experts in the fields for Incident Command and Command and Control.

The published works researched consisted of books, journals, public laws, U.S. Codes, and periodical materials acquired either at, or through the aforementioned institutions. Law libraries provided all of the public law and *U.S. Code of Federal Regulations* references. Periodicals were acquired through the Learning Resource Center at the National Fire Academy. One four hour series of video tapes recording the lectures and interviews at an Executive Fire Officer Alumni (1996) conference was also reviewed. Acquisition of major command and control research documents was attained at the aforementioned military universities and staff colleges while serving on temporary duty at these over the past six months. As a result, eight libraries, in three states, and the District of Columbia were used.

Interviews were either provided face to face (6), over the web by electronic mail (20), or by telephone interview (24). A random selection of installations around the continental U.S., Hawaii,

Germany, Korea, Japan, Italy, Kuwait, and Saudi Arabia were used. The interviews basically asked the senior fire officials the following questions.

1. Please name one to three definition sources for command and control.
2. Please name one or more command and control models.
3. Please describe the command and control model used by your department.

Limitations

There were no significant limitations to either the literature search or to the survey process. Bountiful data was available on military command and control systems, their history and development. Much of the civilian emergency service data was limited and fell under the scope of ICS and command and very little was really modeled for purely command and control of civil emergency services.

Surveys were only limited by the understanding of the senior officials on who was doing the research, as well as what the information would be used, and where the information would be applied/published. Most of the senior fire officials were civil service officials or senior noncommissioned officers. They had to understand that the researcher's rank of Lieutenant Colonel, and position in the Air Force, had no bearing on the research. Once they understood that the author was also a volunteer firefighter doing an independent Executive Fire Officer Program research project, things became more cordial and open. There were no terminology or language barriers encountered during the interviews.

FINDINGS AND RESULTS

Research Question 1

There were numerous (20 discovered) sources of information for the definition of command and control for both military and civilian operations were offered and recorded in this research paper.

Twelve definitions were provided in the research. Most of them had consistent themes as far as showing a relationship between human issues; environmental issues; infrastructure, facilities and systems; and processes or procedures. No one definition was employed on a universal basis, although the fragmentary use of ICS was consistently displayed.

Research Question 2

As was the case in question one, there were (although less) a significant number of models available for the employment of command and control within both the military and civilian sectors. Eight were provided in the research. Again, as was the case of definitions, no single model was employed on a universal basis. And once again, the use of ICS in variant forms was provided.

Research Question 3

There were few sources of information to find conclusive evidence of systems being employed like those discovered in the previous questions. The Air Force employed a standard command system for disaster response, but only in situations where an ICS is necessary, and not so much on a day to day basis amongst the various responding agencies. Stovepipe aligned command systems still existed to attempt to mitigate emergent situations. The interviews (almost 100%) indicated little knowledge of any command and control models with the exception of the NFA standard ICS model, which was not employed in the Air Force.

DISCUSSION

There were no surprises seen in the research findings from the perspective of variant views on the definition of command and control and the fact that these translated into numerous applications in the form of models. Like the term “love” the definition of “command and control” tends to follow a course

of design and expectation for that of the beholder, or owner of the process/authority. It was also not surprising to find the consistent fragmentation and partial employment options existent in the application of ICS in both the civil and military sectors. Translated out in more common terms the research found that while there were many ways of viewing command and control, and there were just as many variant ways of modeling architecture and infrastructure to describe it, there was no single (or even close) to more than usually accepted practice of employment.

This observation, again while not surprising, is still concerning. In today's world of limited resources, high costs for acquisition and maintenance, and time available for their application, the field of emergency services (especially the fire service) cannot continue to not have a single (or least small set of optional) command and control strategies, definitions, and models institutionalized into the day to day practice of emergency response.

This concern is especially paramount in the need to offer shared resources and responders between jurisdictions and intergovernmental agencies (police, fire, EMS). Urgency, complexity, adversity, all present themselves as threats or stimuli during emergent conditions. Hesitancy and incapacity to respond as a result of poor command and control practice is neither acceptable nor palatable for and era that has so many tools available for employment to mitigate the scenarios.

RECOMMENDATIONS

Six recommendations were made as a result the findings from the research. They included,

1. The United States Air Force should apply the same principles for command and control as advocated in Air Force Doctrine for the employment of its core competency of Agile Combat Support as described in the C2 Cube Model. This model has embraced the conduct of command

and control as described by many of the other sources and offers the expectation that it can be employed along a far reaching spectrum of environments in which the Air Force operates (global, theater and unit levels). It is a proven concept embraced by many in other combat and combat support disciplines and offers expectations of success already precedent in literature and historical reference.

2. Emergency service representatives in the Air Force should be trained to understand the principles of command and control, its tenets, and concepts of operation. As stated in the Marine Corps doctrinal application of command and control and as seen in Miller's discussions, decision-making skills, and experiences to judge them against are acquired through participation in event, training, simulation and discussion. Without the advantage of daily catastrophic circumstances (fortunately) the reliance on modalities for knowledge and experience acquisition falls upon the need for more training and simulation. As a result, analysis of threats, potential hazards, and most likely confrontations (with emergent conditions) should be audited, mapped, and developed for scenario simulation, and application modeling. These should be presented in numerous settings to all command level personnel, to include lectures, participatory group activities, chalkboard or tabletop exercises, full-blown demos and exercises, as well as modeling simulators.
3. Courses should be incorporated into all levels of professional development of emergency responders to educate them in the principles of command and control. The need to teach command and control should begin at the recruit level and continue at each progressive phase of professional development in the emergency responder and executive maturation process. The recruit will learn his/her place in the big picture and have a better appreciation of all the factors, variables, complexities, and experiences necessary to command and control forces under duress. In each

phase of a responder's maturation to executive levels, he/she will grow in language and application skills that will be translated into process management techniques for the employment of successful command and control systems and procedures.

4. A single model for command and control, preferably the Agile Combat Support Command and Control Cube (C2 Cube) be accepted as the design for the understanding of command and control processes, elements, and environments. It should be applied for the full scope of emergency service responses, and be employed by all agencies charged with emergency response.
5. The GEDAPER process should be employed as an incident command decision-making tool for all response agencies in the Air Force.
6. The Air Force adopt the National Fire Academy Standard Incident Command System model for use worldwide. This would bring it up to date with a Standard of Care and practice used by most emergency response communities in the United States.

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